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SUBJECT: EVALUATION OF AMBIENT AIR MONITORING CONDUCTED BY THE ALLIANCE OF THE METHYL BROMIDE INDUSTRY IN VENTURA AND MONTEREY/SANTA CRUZ COUNTIES IN 2002

Introduction

The Alliance of the Methyl Bromide Industry (AMBI) conducted ambient air monitoring for methyl bromide in Ventura, Monterey, and Santa Cruz counties in 2002 (AMBI, 2003). The air monitoring was planned to catch the heaviest use scenarios of the region. To evaluate how close the air monitoring achieved this goal, this study is to examine the sites and periods of the air monitoring in relation to the spatial-temporal distribution of methyl bromide use. Also, ambient air concentrations were estimated for heavy use townships and months in California. A similar evaluation and analysis were done before for the air monitoring of methyl bromide conducted by the Air Resources Board (ARB) in 2000 and 2001 (Segawa et al., 2003).

Material and Methods

Spatial Distribution of Methyl Bromide Use and Location of Air Monitoring Sites

Methyl bromide use records of 2002 were queried from the pesticide use report database, and summarized by township and year. Methyl bromide use pounds were also summarized for each section in Ventura, Monterey and Santa Cruz counties over the monitoring periods. Because the soil emission can last several days after fumigation, use periods were extended for three days prior to the corresponding air monitoring periods. GIS maps were generated to illustrate locations of air monitoring sites, and distributions of methyl bromide use pounds during the air monitoring periods.

Frequency Distribution of Township-Monthly Use Pounds

Methyl bromide use pounds were also summarized by township and month. The resultant list consists of total use pounds for each unique combination of township and month. The list was sorted based on use pounds by ascending order, and the cumulative frequency of distribution was calculated and plotted.

Evaluation of Relative Use Around Ambient Air Monitoring Sites

The monthly use of townships with monitoring sites was compared to the township-monthly use distribution to gauge the representativeness of location and time of monitoring. This comparison offered an assessment of whether the monitoring was conducted in heavy use townships and months.

Estimation of Air Concentration

Based on air monitoring data from ARB in 2000 and 2001, and from the AMBI in 2002, regression models were established to estimate ambient air concentrations by methyl bromide use pounds in surrounding areas (Li, et al, 2002). Use areas were assembled as squares of various sizes, such as 1x1, 3x3, 5x5, …, 15x15 mile^2, which used the monitoring site as the centroid. In these linear regression models, the independent variable is the average of weekly use pounds over a square area, and the dependent variable is the average of weekly air concentration for the corresponding period. The estimated air concentration is associated to the center section of the use area. To estimate air concentration from township-monthly use pounds, regression models for a use area of 6x6 mile^2 must be obtained. The 6x6 model was derived from the 5x5 model and the 7x7 model. An area-weighted interpolation was employed to convert regression coefficients of 5x5 model and 7x7 model into those of 6x6 model (Johnson and Li, 2003). The derived model using township-weekly use pounds as input variable is

$$Y = 0.732 + 0.0000721X \quad (1)$$

where Y represents the mean of weekly average air concentrations over a period of eight weeks parts per billion (ppb); and X is the mean of weekly use pounds over the 6x6 mile^2 area in the same period (lbs/6x6sections-week). For the difference of time unit, a factor of 4.286 is applied to the slope coefficient to convert weekly use pounds into monthly use pounds. One month is counted as 30 days in this conversion.

Subchronic Air Exposure Level Assessment

The Department of Pesticide Regulation (DPR) proposed 9 ppb as a regulatory reference concentration for subchronic exposure of methyl bromide. The proposed township use limit corresponding to 9 ppb regulatory goal is 266,194 lbs/township-month (Johnson and Li, 2003). From the township-monthly use frequency distribution curve and the use-concentration relationship, air concentration levels for subchronic exposure can be evaluated with respect to the cumulative frequency distribution of methyl bromide use. For any given concentration, a percentage of township-monthly use that might result in a higher concentration level can be determined.

Results

Use Pounds Distribution and Location of Air Monitoring Sites

The spatial distribution of annual township use pounds for the state is shown in Figure 1. As in previous years, Ventura County, and Monterey /Santa Cruz Counties remained the heaviest use areas of methyl bromide in 2002. Air monitoring sites in Ventura County and Monterey/Santa Cruz Counties, along the sectional use pounds during their corresponding monitoring periods, are shown in Figures 2 and 3. Most air monitoring sites in these counties were in the heaviest use townships, but were not necessarily in the heaviest use sections. This is consistent with AMBI's intent to use monitoring sites "…a reasonable distance away from other fumigation activities…" (AMBI, 2003, page 2). As a result, AMBI's monitoring results may be biased towards lower concentrations (Segawa, 2003).

Frequency Distribution of Township-Monthly Use Pounds

For each township with positive use in 2002, the use pounds in each month were calculated. The cumulative frequency distribution of township-monthly use pounds in 2002 for the whole state is shown in Figure 4. Although the use pound covers a wide range, from 0 to 232,592 lbs/township-month, 90% is less than 19,500 lbs/township-month, and 95% is less than 38,000 lbs/township-month. Of the 769 township-months with methyl bromide use in 2002, no township-monthly use exceeded the proposed use cap (266,194 lbs/township-month).

Top Annual Use Townships

The annual use pounds of methyl bromide for the top ten townships ranged from 472,819 lbs to 161,624 lbs in 2002 (Table 1). Nine of the top ten townships were either in Ventura County or in Monterey/Santa Cruz Counties, and eight were monitored by the AMBI in 2002. There were two townships with more than one monitoring site. Methyl bromide use in these townships exhibited an apparent seasonal pattern. The heavy use period occurred from July through September, which corresponded with the period of air monitoring. There was very little use during the winter seasons.

Percentiles of Monitored Township-Monthly Uses

The AMBI air monitoring in Ventura County was primarily conducted in July and August, and in September and October for Monterey/Santa Cruz Counties. The monitored township-monthly use was compared to the township-monthly use distribution curve (Figure 4), and the percentile of monitored township-monthly use pounds is determined (Table 2). All top five cases of township-monthly use were monitored. The percentiles of township-monthly use pounds were

above 95% for most monitoring sites. In other words, 95% of township-month use pounds in California in 2002 were lower than those of monitored townships and months. Most of these heavy use cases were in areas of Monterey/Santa Cruz and Ventura/Santa Barbara.

Air Concentrations for the Top township-Month Use Cases

There were 51 townships with estimated air concentration equal or greater than 1 ppb for at least one month (Table 3). The maximum township-monthly use was 232,592 lbs in 2002, with the estimated air concentration of 4.64 ppb. Although this number is far below the reference level of 9 ppb for controlling subchronic exposure, it is higher than that of 2001 (4.14 ppb). The estimated air concentration is only for the center of a township, and it should not be regarded as the average concentration of the township. It is likely that air concentrations of certain sections within the township are higher than this estimated concentration.

Conclusions

The ambient air monitoring by the AMBI in 2002 was conducted in high-use areas during high-use periods. The monitoring locations and periods covered the townships and months with the top use intensity. The air monitoring captured the heaviest use scenarios in California in 2002. Not a single township had a monthly use level that led to an air concentration level of 9 ppb in 2002.

References

Alliance of the Methyl Bromide Industry, 2003. Methyl bromide air monitoring: Ventura, Santa Cruz, and Monterey Counties, July-October, 2002. Alliance of the Methyl Bromide Industry, Sacramento, CA.

LinYing Li, Bruce Johnson and Randy Segawa, 2002. Analysis of methyl bromide ambient air concentration data monitored by the Air Resources Board and the Alliance of Methyl Bromide Industry in year 2001(draft). California Department of Pesticide Regulation, Sacramento, CA.

Bruce Johnson and LinYing Li, 2003. Memorandum to Randy Segawa dated on July 11, 2003: Calculation of a tolerance interval for a township limit on methyl bromide use to control subchronic exposure. Environmental Monitoring Branch, California Department of Pesticide Regulation, Sacramento, CA.

Randy Segawa, Bruce Johnson, Lin Ying Li, and Johanna Walters, 2003. Memorandum to John Sanders dated on July 24, 2003: Evaluation of ambient air monitoring and township-month use pound distribution of methyl bromide for subchronic exposure assessment. Environmental Monitoring Branch, California Department of Pesticide Regulation, Sacramento, CA.

Randy Segawa. 2003. Evaluation report dated June 23, 2003 of "Methyl Bromide Air Monitoring: Ventura, Santa Cruz, and Monterey Counties, July – October, 2002." Environmental Monitoring Branch, California Department of Pesticide Regulation, Sacramento, CA.

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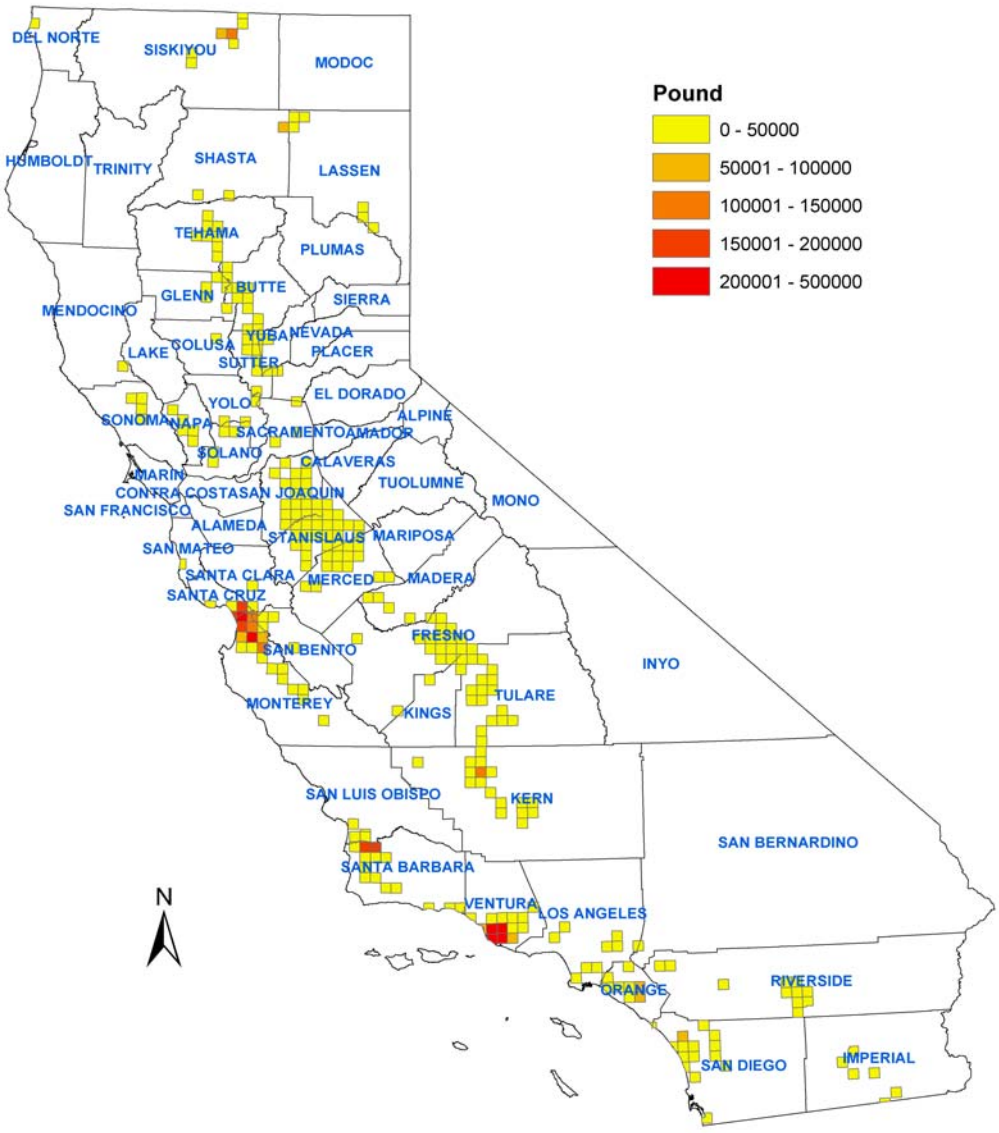

Figure 1. Distribution of annual township use pounds of methyl bromide in 2002

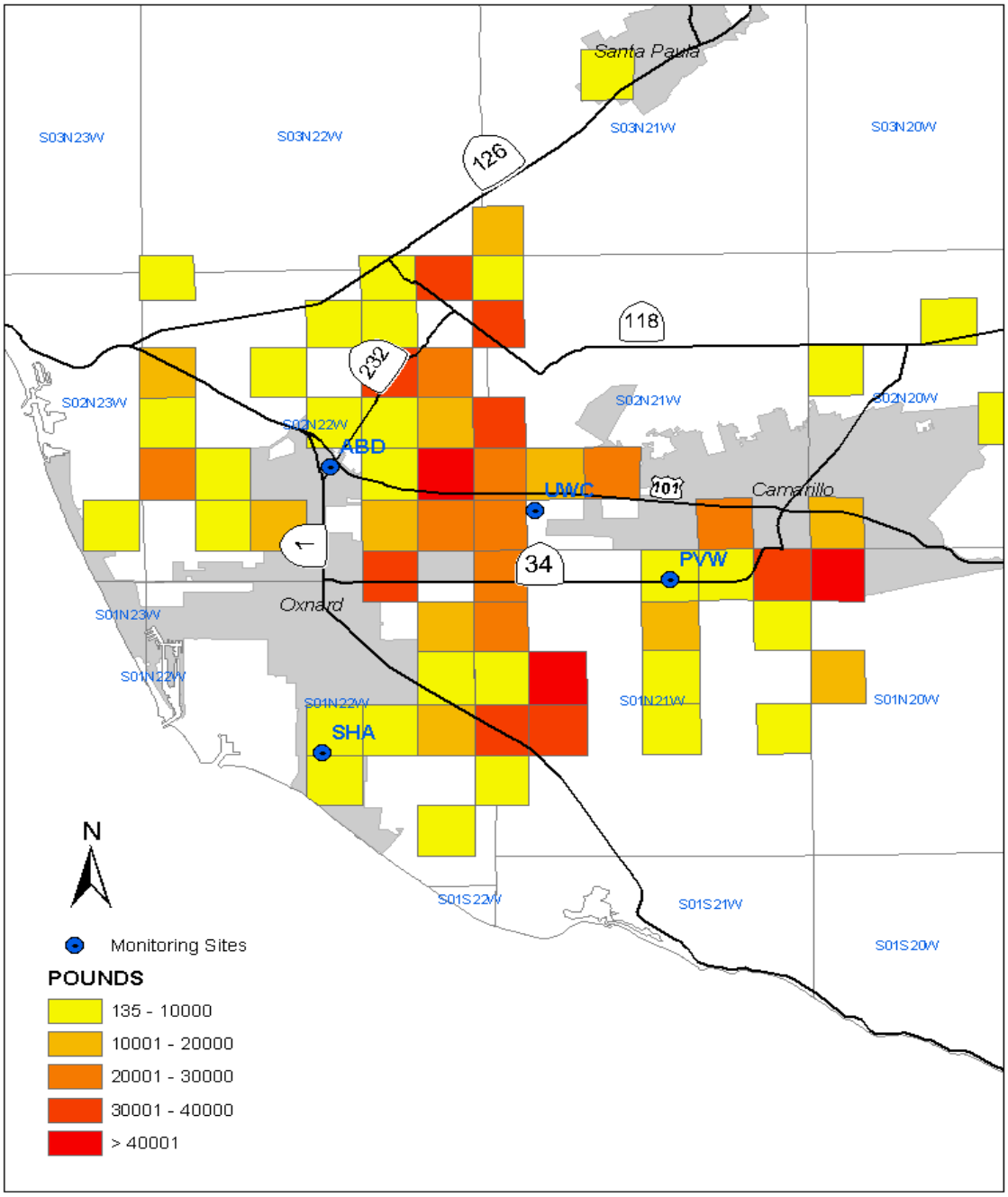

Figure 2. Location of air monitoring sites in Ventura County, and distribution of methyl bromide use during the monitoring period in 2002 (July 7 - August 31)

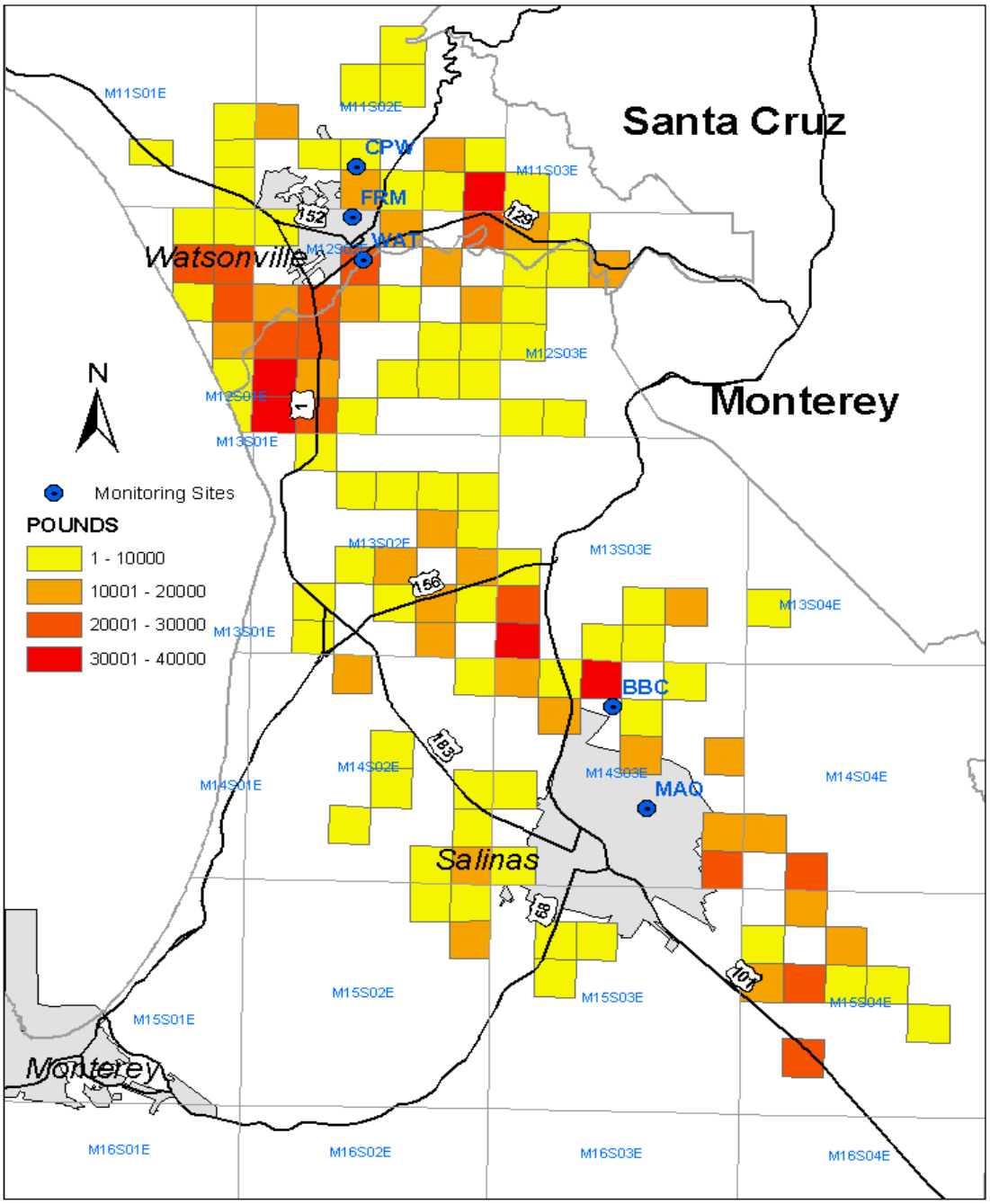

Figure 3. Location of air monitoring sites in Monterey and Santa Cruz Counties, and distribution of methyl bromide use during the monitoring period in 2002 (September 1 - October 27)

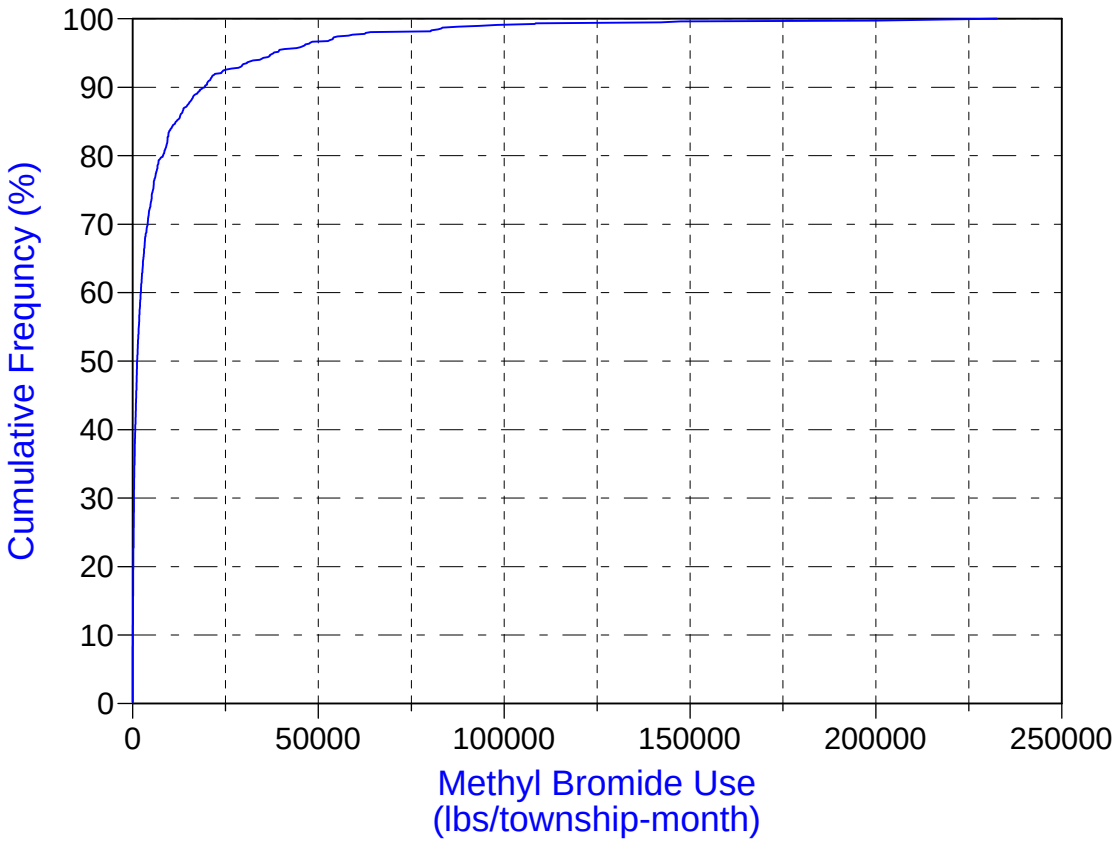

Figure 4. Frequency Distribution of township-monthly use of methyl bromide in the State of California in 2002

Table 1. Top 10 townships of annual methyl bromide use (lbs/township) in 2002 and use distribution in each month

County	Site	Township	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Monterey/Santa Cruz	FRM,WAT	M12S02E	0	0	0	0	0	3718	12905	**108490**	**200296**	**147410**	0	0	472819
Ventura	ABD	S02N22W	615	553	2101	0	**20047**	**62801**	**82965**	**216163**	**29136**	998	1553	2156	419088
Ventura	PVW	S01N21W	982	157	2543	4347	**20140**	15275	**24268**	**232592**	**53880**	1183	2450	593	358410
Monterey	BBC,MAQ	M14S03E	0	1071	0	0	5634	14754	**23856**	**54108**	**93334**	**47498**	0	0	240255
Ventura	UWC	S02N21W	0	240	0	5896	0	3135	**39496**	**142130**	**24401**	0	1650	1246	218194
Ventura	SHA	S01N22W	1013	1203	149	417	**16929**	**47829**	6709	**87631**	**37327**	691	1327	**16565**	217790
Santa Cruz		M12S01E	0	0	0	3247	1360	9642	**29442**	**22184**	**80223**	**45722**	1217	0	193037
Santa Cruz	CPW	M11S02E	0	0	0	469	4174	4469	334	**37861**	**80358**	**36899**	6694	601	171859
Santa Barbara		S10N33W	0	0	180	0	0	**18071**	0	0	**64013**	**83382**	128	0	165774
Monterey		M13S02E	0	0	5170	4549	1456	0	0	6483	**53093**	**53927**	**36946**	0	161624

* Numbers in bold fond indicate the township-month use might result in an air concentration higher than 1 ppb

Table 2. The percentile of township-monthly use cases monitored by AMBI in 2002

County	Site	Township	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Monterey/Santa Cruz	FRM,WAT	M12S02E									99.74	99.61			
Ventura	ABD	S02N22W							98.57	99.87					
Ventura	PVW	S01N21W							92.33	100.00					
Monterey	BBC,MAQ	M14S03E									98.96	96.36			
Ventura	UWC	S02N21W							95.45	99.48					
Ventura	SHA	S01N22W							78.41	98.83					
Santa Cruz	CPW	M11S02E									98.31	94.54			

Table 3. Townships with estimated air concentration ≥ 1 ppb for at least one month in 2002

Rank	Township	County	Max Month Use (lbs/mo)	Concentration (ppb)
1	S01N21W	VENTURA	232,592	4.64
2	S02N22W	VENTURA	216,163	4.37
3	M12S02E	MONTEREY,SANTA CRUZ	200,296	4.10
4	S02N21W	VENTURA	142,130	3.12
5	M46N01W	SISKIYOU	108,200	2.55
6	S10N34W	SAN LUIS OBISPO,SANTA BARBARA	98,116	2.38
7	M14S03E	MONTEREY	93,334	2.30
8	S01N22W	VENTURA	87,631	2.21
9	S10N33W	SAN LUIS OBISPO,SANTA BARBARA	83,382	2.13
10	S05S08W	ORANGE	82,151	2.11
11	M11S02E	SANTA CLARA, SANTA CRUZ	80,358	2.08
12	M12S01E	MONTEREY,SANTA CRUZ	80,223	2.08
13	M15S04E	MONTEREY	62,467	1.78
14	S02N23W	VENTURA	59,172	1.73
15	S01N20W	VENTURA	55,135	1.66
16	M13S02E	MONTEREY	53,927	1.64
17	M13S03E	MONTEREY,SAN BENITO	52,596	1.62
18	M46N02W	SISKIYOU	48,412	1.55
19	M12S03E	MONTEREY,SAN BENITO,SANTA CLARA,SANTA CRUZ	46,484	1.51
20	M14N03E	SUTTER,YUBA	46,311	1.51
21	M14S02E	MONTEREY	45,181	1.49
22	M27S25E	KERN	40,853	1.42
23	M09N09W	SONOMA	39,376	1.39
24	M37N05E	LASSEN, SHASTA	39,259	1.39
25	S10S04W	SAN DIEGO	38,096	1.37
26	M14S04E	MONTEREY,SAN BENITO	32,419	1.28
27	M47N01E	SISKIYOU	31,619	1.26
28	S06S08W	ORANGE	30,744	1.25
29	M02S07E	SAN JOAQUIN, STANISLAUS	29,522	1.23
30	M27S26E	KERN	26,577	1.18
31	S09N33W	SANTA BARBARA	25,240	1.16
32	M15S03E	MONTEREY	24,054	1.14
33	S08N34W	SANTA BARBARA	21,952	1.10
34	M23S25E	TULARE	21,504	1.09
35	M06S12E	MERCED	21,417	1.09
36	S05S08E	RIVERSIDE	21,275	1.09
37	M14S13E	FRESNO	21,000	1.09

Table 3, cont. Townships with estimated air concentration ≥ 1 ppb for at least one month in 2002

Rank	Township	County	Max Month Use (lbs/mo)	Concentration (ppb)
38	M18S06E	MONTEREY	20,485	1.08
39	M21N03W	GLENN	20,289	1.07
40	M06S08E	STANISLAUS	20,070	1.07
41	M43N05W	SISKIYOU	19,547	1.06
42	M08S15E	MERCED	19,505	1.06
43	M19S25E	TULARE	19,391	1.06
44	S03N21W	VENTURA	18,670	1.05
45	S11S05W	SAN DIEGO	18,079	1.04
46	M15S02E	MONTEREY	17,822	1.03
47	M27N02W	TEHAMA	17,511	1.03
48	M12S04E	SAN BENITO,SANTA CLARA	17,443	1.03
49	M05S13E	MERCED	16,286	1.01
50	S14S15E	IMPERIAL	16,170	1.00
51	M29N13E	LASSEN	15,913	1.00